# SECTION 6
# PNEUMATIC DUCTOR COLOR CONTROL

This section describes the features of the pneumatic ductor color control. This includes the functional description, the user and operator selectable parameters, etc.

## 6.1 FEATURES

- Replaces the mechanically cammed ductors on the decorator.
- Directly controls the cyclic ductor solenoids to a resolution of one tenth of a can, at speeds up to 2400CPM.
- Enables the operator to perform quick label changes by recalling the ductor "Cycle" and "On" duration used the last time the particular label was run.
- Incorporates optional ductor feedback sensor inputs to compensate for the response time of the solenoid and verify that the ductors are cycling.
- Keypad adjustment of label parameters (label number, cycle duration and on duration).
- Stores label parameters for up to 100 labels.
- User selectable ductor configuration parameters including, maximum "Cycle" duration, maximum "On" duration, response time compensation and individual ductor feedback enable.
- Passcode security access for adjusting label parameters.
- Manual/Off/Auto modes of operation.
- Provides control for up to 8 ink station machines.

# SECTION 6
# PNEUMATIC DUCTOR COLOR CONTROL

## 6.2 FUNCTIONAL DESCRIPTION

The pneumatic ductor color control replaces the mechanically cammed ductors with pneumatically controlled ductors. The ductors are now activated by air cylinders controlled by solenoids driven by the M4508. This allows the cycle duration (number of cans between one complete ductor cycle) and the duty cycle (the time the ductor is in contact with the fountain roll or "On" duration) to be adjusted independently for each ink station. This allows the ink flow rate of each station to be adjusted based on the amount of ink required for each particular color on the label.

The maximum "Cycle" duration, maximum "On" duration and "Response Time" compensation are set using the Keypad/Display. These values are used with all labels. The color control allows up to 100 labels to be saved. This allows the operator to perform quick label changes by recalling the settings used the last time the particular label was run. Thus when a label change is made, the corresponding label number is selected and settings for each ink station, used for that label previously, are used again.

When the machine first starts up, the ductors are staged "ON" in one-can increments. At the beginning of each cycle, the ductor solenoid is activated and the ductor roll comes in contact with the fountain roll. Once the "On" duration is complete, the solenoid is deactivated and the ink is transferred to the first steel roll. At the completion of the cycle, there is a 5-can dwell period before the next cycle starts. During this dwell period ductor cycling operation is checked and adjustments made to the "On" duration for the response time of the solenoids.

## 6.3 DUCTOR FEEDBACK

Sensors mounted on the machine sense the actuation of the ductor arm, verifies that the ductor is cycling and compensates for the response time of the solenoid. As the speed of the machine changes, the feedback sensor is used to adjust the amount of time the ductor is in contact with the fountain roll. This allows consistent ink transfer throughout the entire speed range of the machine.

If a ductor is not detected as cycling, an output is activated to indicate a fault in the ductors cycling operation.

**Note:** The feedback sensor must go "ON" when the ductor is in contact with the fountain roll.

## 6.4 OPERATOR ADJUSTABLE PARAMETERS

The following parameters can be adjusted through the "Color Control" key on the Keypad/Display:

- Label Number (0-99)
- Ink Station "On" Duration
- Ink Station "Cycle" Duration

**Note:** The above values are passcode protected to prevent unauthorized personnel from making adjustments. Also, the "On" duration and "Cycle" duration cannot be set with in 14 cans of one another.

Passcode protection can be enabled or disabled via the passcode itself. If the passcode is set to zero or the "Set-Up Enable" input is ON then passcode protection is disabled, otherwise passcode protection is enabled. If passcode protection is enabled, the operator must enter the proper passcode in order to make adjustments to the color control parameters. If the "Set Passcode" input is ON then a new passcode can be entered. If a passcode is not entered, the value is reset to zero.

## 6.5 SET-UP PNEUMATIC DUCTOR PARAMETERS

This menu is activated when the "2" key (SET PNEUMATIC DUCTOR PARAMETERS) is pressed while the primary set-up menu is active (using the Keypad/Display). The following four set-up parameters may then be adjusted or viewed:

**Note:** For virtually all the menus, the <NEXT> and <PREV> keys can be used to advance to the next or previous parameter respectively. To change the currently displayed parameter, enter the new value on the numeric keypad and press <ENTER>. The value will be entered and the next parameter will automatically be displayed. When the last parameter in a section is entered, the primary set-up menu is again displayed. Pressing <ESC> at anytime will exit back to the primary set-up menu.

The following parameters are used to define the ductor configuration:

**Maximum "Cycle" Duration:** The maximum "Cycle" duration is set to $1/10^{th}$ of a can resolution. The range of this parameter is from 140 to 650 and defines the upper limit or the longest amount of time between ductor cycles. Care should be taken not to set this parameter too low, as this would restrict the operators range of adjustment. The "Cycle" duration is set individually for each ink station and is the rate at which ink is transferred from the fountain roll.

**Maximum "On" Duration:** The maximum "On" duration is set to $1/10^{th}$ of a can resolution. The range of this parameter is from 0 to 200 and defines the upper limit or the longest amount of time the ductor roll can be in contact with the fountain roll. The "On" duration is set individually for each ink station and is the amount of time the ductor roll is in contact with the fountain roll.

**Response Time Compensation:** The response time compensation parameters is used to adjust the "On" duration based on the difference between the "ON" and "off" response time of the ductor solenoid. As and example, if the "ON" response time were 40 msec. and the "off" response time was 15 msec., then this parameter would need to be set to 25 msec.

The "ON" response time is defined as the time ductor is activated to the time it comes in contact with the fountain roll. The "off" response time is the time the ductor is deactivated to the time it lifts off of the fountain roll. If the optional feedback sensors are to be used, this parameter should be set to zero.

**Color Gain:** This parameter allows the color density to be increased proportionately up or down as a function of machine speed. The valid range of this parameter is 50% to 150% per 2000 CPM. When set to 100%, no increase or decrease, as a function of speed will occur. When set to 50%, the color density will drop 50% from 0 to 2000CPM. When set to 150% the color density will increase by 50% from 0 to 2000CPM. This parameter is used to compensate for ink atomization (misting) as a function of speed (higher speed = proportionately higher ink misting).

**Feedback Enable (stations 1 – 8):** This parameter enables the individual feedback faults and should only be used when the optional feedback sensors are used. Once enabled, the M4508 will verify that the ductor is cycling properly. If a ductor is not detected as cycling properly, the "Ductor Feedback Fault" is energized, indicating a problem with the ductor cycling control.

If a "Ductor Feedback Fault" does occur, the ductors should be manually activated to verify proper cycling operation, as well as, the sensor for proper feedback operation. The feedback sensor should be set such that it is only "ON" when the ductor is in contact with the fountain roll.

### 6.5.1 DEFAULT DUCTOR CONFIGURATION SETTINGS

As shipped, the ductor configuration settings are as follows:

Maximum Cycle Duration (0.1 cans) _____: 500
Maximum ON Duration (0.1 cans) _____: 200
Response Time Compensation (msec) _____: 25
Color Gain (CG-100% per 2000CPM) _____: 100%
Feedback Enable (Stations 1 – 8) _____: N

## 6.6 MANUAL/OFF/AUTO CONTROL

The ductor MANUAL/OFF/AUTO selector switch is used to determine the mode of the ductors. The three different modes operate as follows:

**MANUAL:** Ductors cycle normally while the decorator is running (Ductor Auto "On" input from host PLC ignored). Ductors turn "off" (rest on first steel roll) when the decorator reaches zero speed. While the decorator is stopped, each individual ductor can be toggled "on" and "off" by pressing the keypad number corresponding to it's station. This provides a test method to verify the operation of each ductor.

**OFF:** Ductors always "off" (resting against first steel roll).

**AUTO:** Ductors cycle normally while decorator is running and the Ductor Auto "On" input from the host PLC is "on". Ductors turn "off" when decorator reaches zero speed or when Ductor Auto "On" input from host PLC is "off".

## 6.7 OVERVIEW OF KEYS RELATING TO THE COLOR CONTROL

**<COLOR CONTROL>**: Pressing this key allows the operator to select a new label number, adjust the "Cycle" and "On" durations, independently for each ink stations or program a new label from scratch. This key is passcode protected when the "Set-Up Enable" switch is not disabled.

When the "Color Control" key is depressed, the label selection screen is displayed. The operator may enter in a new label number or press either the <NEXT> or <ENTER> keys to advance to the next station.

**<NEXT>**: Pressing this key moves to the next adjustment field. Holding this key depressed for one second will move to the next field continuously. If selection has reached bottom of the order, this key will have no effect.

**<PREV>** (Previous): Pressing this key moves to the previous adjustment field. Holding this key depressed for one second will move to the previous field continuously. If selection is returned to the top of the order, this key will have no effect.

**<INC>** (Increment): Pressing this key once increments the currently selected value by one. Holding this key depressed for one second will increment the currently selected value continuously. This key is only active in the "Color Control" mode.

**<DEC>** (Decrement): Pressing this key once decrements the currently selected value by one. Holding this key depressed for one second will decrement the currently selected value continuously. This key is only active in the "Color Control" mode.

## 6.8 RECOMMENDED PROCEDURE FOR USING THE COLOR CONTROL

With a mechanically cammed ductor, the keys on the fountain are used to control the areas the ink is applied, as well as the color quality (light or dark). The keys are adjusted proportionally to where the color was located as well as how much area the color covered and how dark the color was.

With the pneumatic ductor, the color quality is now controlled by the frequency and duty cycle of the ductor (as set through the Keypad/Display). The fountain keys are simply used to define the locations (top, bottom, middle, etc.) the color is located on the can. The keys should not be adjusted proportional as before, but should be either closed at areas where there will be no color on the can, or opened (a predefined number of turns) on areas where the color is located on the can.

This allows label changes to occur quicker by simply setting the keys open or closed at the locations required on the can, and selecting the label number for the respective label on the Keypad/Display (thus setting the color quality to the same level as previously set for that label).

The M4508 is capable of saving the settings for up to 100 labels in the internal memory. As different labels are run on the machine, different labels can be programmed and added to the internal database. When a label, which has already been programmed, is run again, simply recall the label number and the ductors will oscillate at the same frequency and duty cycle they did the last time the label was run. The only additional set-up required at label change is to set the keys open and closed at the required areas on the can.

The following sections describe the recommended procedure for setting up a label and the recommended procedure for a label change over using a label, which has previously been programmed into the color control.

## 6.9 SELECTING THE LABEL NUMBER

To select a label, perform the following:

1) Press the <COLOR CONTROL> key to enter the adjustment mode.

2) If the prompt "ENTER PASSCODE:" is displayed, enter the corresponding 1 to 5 digit passcode on the numeric keypad and press <ENTER>. If the prompt "ENTER PASSCODE: INCORRECT PASSCODE" is displayed, enter the correct passcode and press <ENTER>.

3) The "LABEL" field is displayed. Enter a new label (0-99) on the numeric keypad and press <ENTER> or press the <NEXT> key to use the existing label.

   **Note:** The decorator must be stopped in order to change the label number.

4) If no further changes are to be made to the ink stations settings, press <ESC> to exit.

## 6.10 LIGHT/DARK COLOR ADJUSTMENT

The "On" duration and "Cycle" duration for each ink station can be set individually for each label number. The "On" duration can be viewed as a "Course" adjustment and the "Cycle" duration can be viewed as a "Fine" adjustment. Observe how changing either the "On" duration or "Cycle" duration, changes the relative "Color Density".

**Note:** If an ink station is not used, simply set its "On" duration to zero to disable the cycling operation.

Use the "Color Density" display as an indication of the amount of ink being transferred by the ductor. Different settings of the "On" and "Cycle" durations will achieve the same "Color Density".

**Note:** To reduce "Light" and "Dark" variations in print between cycle times, adjust both the "On" duration and "Cycle" duration down to achieve the same "Color Density".

For a new label or existing label that needs color adjustment, perform the following:

1) Press the <COLOR CONTROL> key to enter the adjustment mode if not already in adjustment mode.

2) To select the desired ink station for adjustment, press the <NEXT> or <PREV> keys until the desired ink station is displayed.

3) To lighten the color, start by decreasing the "On" duration or increasing the "Cycle" duration. Watch the "Color Density" to see how your adjustments change this value. Remember, think of the "On" duration as a "Course" adjustment and the "Cycle" duration as a "Fine" adjustment.

4) To darken the color, start by increasing the "On" duration or decreasing "Cycle" duration. Watch the "Color Density" to see how your adjustments change this value. Once again, think of the "On" duration as a "Course" adjustment and the "Cycle" duration as a "Fine" adjustment.

5) Check the color quality and continue to increase or decrease the "Color Density" until the desired color quality is achieved.

6) Perform steps (2) through (4) above for all ink stations used as necessary.

7) Once the label quality is satisfactory, press the <ESC> key to exit the adjustment mode and save the changes for the selected label.

## 6.11 CHANGEOVER USING AN EXISTING LABEL

When a label is run again, perform following to set-up the label at change over.

1) Select the respective label number on the Keypad/Display.

2) Set the keys open (predefined number of turns, a number which is used for all ink stations on all labels) on the areas of the can that will have ink and closed on areas that will not have ink.

3) Run the machine and verify that ink is being distributed on the can correctly. The ink will be metered at the same rate as previously set the last time the label was run. Only minor adjustments to the keys may be necessary to assure that ink is not distributed to areas where no color is applied (resulting in slinging due to ink build up).